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# Spin-selective detection and manipulation of ultracold neutrons

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Ultracold neutron (UCN) experiments suffer from low counting statistics, especially in precision measurements such as searches for the neutron electric dipole moment (nEDM). In-situ experimental designs, where all measurement and detection steps occur within a superthermal UCN source, have the potential to significantly increase the usable UCN density. Such approaches require novel detector concepts adapted to the in-situ environment.

In this work, we describe a spin-selective detector concept that combines localized magnetic fields, generated by superconducting microstructures, with a neutron-absorbing multilayer. In the presence of a magnetic field, high-field-seeking neutrons have an increased probability to penetrate a reflecting layer and reach a neutron absorber underneath. The corresponding probability for absorbing low-field-seeking neutrons is significantly lower, which creates an effective window for spin discrimination.

This detector concept has the potential to contribute to overcoming certain limitations in current nEDM experiments and enables new strategies in quantum sensing, UCN storage, and quantum computation with neutrons.

We present the current development status, initial characterization results, and outline future measurement plans using polarized neutron reflectometry.

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